ADVANCED COMPUTER FOR MEDICAL RESEARCH

SPECIAL RESEARCH RESOURCE PROJECT GRANT

| PROGRESS REPORT | to 7/31/67

Period (same as current 12 month budget period)	Grant Number
From 9-1-66 through 7-31-67 (11 mos.) mo./day/yr. mo./day/yr.	FR 00311-01

Name of Principal Investigator	Title	Academic Department
Lederberg, Joshua	Professor	Genetics

Name of grantee institution	Address of Resource
Stanford University School of Medicine	Stanford University School of Medicine Palo Alto, California

Type of Institution (Private Univ., State Univ., etc.)	Professional School	Tele. No.
Private University	Medicine	area code 415 321-2300 ext. 5049

Name of Institution's Special Research Resource Advisory Committee
(if any)

Computer Policy Committee
Advanced Computer for Medical Research (ACME)

Name, Title, Department and Institution of each member (indicate chairman)

Name	Title	Dept.	Institution
see next page			

Signature of Principal Investigator	Date

Computer Policy Committee

Advanced Computer for Medical Research (ACME)
School of Medicine
Stanford University

Dr. Joshua Lederberg (chairman)	Genetics, Biology	Professor
Dr. J. Weldon Bellville	Anesthesia	Professor
Dr. Edward A. Feigenbaum	Computer Science Computation Center	Associate Professor Director
Dr. Robert J. Glaser	School of Medicine	Dean
Dr. Anthony J. Hance	Pharmacology	Assistant Professor
Dr. Frank Morrell	Neurology	Professor
Dr. Lincoln E. Moses	Statistics Preventive Medicine	Professor
Dr. Lubert Stryer	Biochemistry	Associate Professor
Dr. C. Peter Rosenbaum	Psychiatry	Assistant Professor
Mr. Gio Wiederhold	ACME Facility Stanford Computation Center	Associate Director

During this development phase of the ACME System various uses of the computer

are handled as follows:

a) Timesharing service takes place at fixed scheduled hours, Monday through Friday. In addition timesharing service is provided whenever reasonably sized timeslots are not otherwise used, especially on weekends.

b) On-line data acquisition service takes place at scheduled times to meet the individual project's needs.

c) System development and check-out requiring hands-on attention of members of the staff is generally unscheduled, and done on a first in, first on basis, modified as to the urgency of the work. General guidelines for this use are established weekly in the staff meeting.

d) Off-line system development and batch processing are generally run at night (10:00 p.m. to 7:00 a.m.) and the results are normally available early in the morning.

e) The twenty percent Central Computation Facility usage is also during the night period.

The facility is under full control of the ACME project, and the supervisor of

operations is a member of the ACME staff. To provide 24-hour-7-day operator coverage

at the lowest cost the operator staff is pooled with that of the main Computation

Center at Stanford and operator service is guaranteed for the ACME System.

The entire ACME Facility operates as one of the Stanford Computation Center

facilities and receives administrative assistance and technical information through

the central offices. It is housed in the medical school, however, and operates on

an independent budget and its professional staff is solely responsible to the

medical school and the needs of medical researchers, as represented by the Medical

Computer Committee.

Much co-operation is being experienced from the initial complement of users

and the organizational structure seems adequate to the demands made on it.

The principal application of the facility during this introductory period has been for system development. The hardware of the 360/50 was finally checked out by I.B. M. and the system turned over the ACME Facility on December 15, 1966. As of April 30, 1967, the ACME system had some limited capability. The greatest lack at that date was the file capability: (I.B. M. support for this did not arrive until February 15, 1967). It is expected that the resource will have been developed enough to be generally useful and accountable to the medical school research community by June 1, 1967.

The computer is being operated on a full 24-hour-7-day a week basis. Eighty percent of this time is available to ACME and twenty percent to the Central Campus Facility according to the terms of cost allocation for the hardware. Full staffing has resulted in very reliable operations under unfavorable conditions; and the ACME computer has shown an availability of 97.5% (after scheduled maintenance) during the period from 12/12/66 to 4/09/67. Most of the computer's time is being used for ACME hardware and software check-out. However, users problems are routinely run overnight and occasionally with faster turnaround.

Timesharing service to users is currently offered three hours a day, an allocation expected to increase rapidly. Use of this time is not yet accounted for since system reliability and facilities are too limited, and should be regarded as devoted mainly to preliminary user indoctrination and system check-out.

The batch operations are an interim expedient since the requirements for time-sharing have taken precedence in both hardware and software selection. As the ACME system becomes more powerful batch work need take only a small proportion of the computer time available. We are finding that our efficiency under time-sharing exceeds that of the presently available batch operating system!

We are now able to communicate properly with non-IBM supported devices as PDP-8's, Linc-computers, displays, and data transmissions apparatus. The integration of these programs into the time-sharing system began May 1, 1967, and limited user availability is expected in June. In the meantime, check-out of hardware and some production data acquisition is taking place on a scheduled non-time-sharing basis using the software in its current status.

Some of the pioneering users on the present breadboard system are:

Dr. Wasserman, Respiration Laboratory
Dr. Mesel, Pediatric Cardiology
Dr. Von Der Groeben, Anesthesia

All of this work, however, occupies still less than 5% of the computer's capability.

A considerable amount of staff time has been spent in discussing the feasibility and approach to computer applications on a large number of projects with the staff and faculty of the medical school. ACME has gathered a good impression of the range of problems to which the system will have to respond, and it also has found a few that cannot be solved with current technology and facilities.

A monthly seminar is conducted to inform the medical school of the progress of the project. Some of these seminars are also utilized to give the ACME staff an opportunity to hear expositions of relevant work in other institutions. During November through February a series of 15 four-and-one-half hour courses were conducted which were successfully completed by 167 members of the medical school faculty and staff. A number of faculty members wrote programs using the leased Babcock terminal. These are now used regularly and are due to be transferred to the ACME system as soon as the file capability is available.

SUMMARY OF COMPUTER RESOURCE USAGE

Period covered from __12-15-66__ through __4-30-67__
  mo./day/yr.   mo./day/yr.

Hours of Service Received

Name of Investigator	Consulting and/or Programming	Peripheral Equipment	Computer Equipment
Emmanuel Mesel	80	20 (IBM 1800)	
Bert Kopell	20		
William H. Forrest, Jr.		75 (Babcock Terminal)	
E. Dong, N.E. Shumway, W. Angell		60 (Babcock Terminal)	
J. von der Groeben	40		8
Donald C. Harrison	80		
Sidney Liebes, Jr.		20 (Babcock Terminal)	

Subtotals

Other

Totals

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: Emmanuel Mesel, M.D.

Department: Pediatrics

Institution: Stanford Medical School

Field of Investigation: Cardiovascular hemodynamics

Title of Research Project: Blood flow and ventricular performance in
congenital heart disease

Direct Grant or Contract Support of Project		
Identification Number	Funding Agency	Current Annual Amount
1. 66- 754	American Heart Association	12,650
2.	Santa Clara County Heart	
3.	Association	3,100
4.		
5.		
6.		
7.		

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
80		20 (1800)			

Description of Research Project
(Approximately 300 words)

In contrast to previous idealized models that consider mixing to be
instantaneous, W.A. Conrad* has presented a theory of indicator dilution
curves which assumes that the mixing process has inertia and a finite
mixture time. The new theory has at least two inherent advantages over
its predecessors: (1) The ascending portion of the curve alone can be
used for predicting the remainder of the curve. Though resembling the
"forward triangle" method of Hetzel and coworkers, it does not have
an empiric basis. In preliminary checks of the curve fitting capability
of the inertial mixing theory obtained by matching theoretical solutions
with dilution curves from human cardiovascular systems, an average area

*Seventh Inter-American Congress of Cardiology, 14-19 June 1964

error of 2% has been achieved. Further systematic investigation is
planned to determine the applicability of the method in situations
where the terminal portion of the curve is distorted by shunt flow
and recirculation. (2) The derived parameters of the lumped-constant
conceptual model, the inertial constant and mixture time, are in part
related to forcefulness of ventricular contraction (when injection of
the indicator is made into a ventricle). Thus, if certain variables
(heart rate, mechanical aspects of the injection and sampling systems)
are controlled, the inertial constant and mixture time should be an
indirect index of ventricular performance. Investigations are there-
fore planned to explore the possibilities that these parameters can
be used to characterize ventricular performance in infants and children
with congenital heart disease.

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: Bert S. Kopell

Department: Psychiatry

Institution: Stanford School of Medicine

Field of Investigation: Hormones and Behavior

Title of Research Project: Hormones and Behavior

Direct Grant or Contract Support of Project

	Identification Number	Funding Agency	Current Annual Amount
1.	2 HSZ-489	Mental Health 10976	$146,908
2.	Steriod Grant	Mental Health 10976	$ 3,050
3.			
4.			
5.			
6.			
7.			

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
20					

Description of Research Project
(Approximately 300 words)

Study of effects of Cortisone and other hormones in the evoked potential in order to measure the effect on preception in stress situations. FM modulated signals will travel over four private phone lines from the V.A. Hospital.

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: William H. Forrest, Jr.

Department: Anesthesia

Institution: Stanford - VA-PAH

Field of Investigation: Clinical Pharmacology

Title of Research Project: Clinical evaluation of analgesics, sedatives anti-emetics, methodologic problems.

Direct Grant or Contract Support of Project

Identification Number	Funding Agency	Current Annual Amount
1. none	V.A.PAH	$65,000
2. D-66-2	NASNRC	7,500
3. D-66-5	NASNRC	7,500
4.		
5.		
6. (2-HEZ-413-94610)	Pharmaceutical House	8,000
7. (2-HEZ-605-94610)		

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
		75 (Babcock)			

Description of Research Project
(Approximately 300 words)

Clinical evaluation of analagesics, sedatives, anti-emetics, using double techniques with trained nurses as observers and post-operative patients as subjects. This is a cooperative study collecting large volumes of data and the computer is used for data management problems and analyses and additionally evaluating into methological problems.

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: Drs. E. Dong, N.E. Shumway, W. Angell

Department: Cardio-Vascular Surgery

Institution: Stanford

Field of Investigation: Cardio-Vascular Surgery and Physiology

Title of Research Project:

Direct Grant or Contract Support of Project

	Identification Number	Funding Agency	Current Annual Amount
1.	66-676	American Heart	$12,000
2.	HE-11022-01	USPHS	42,000
3.	HE-08696-04	USPHS	50,000
4.	66-1619	American Heart	10,000
5.		Research	5,000
6.			
7.	0	USAF	0

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
		60 (Babcock)			

Description of Research Project
(Approximately 300 words)

Description of Research Project:
1. Determination of blood volume from Evans blue delution
2. Determination of RBF using Tc99 single injection - 2 compartment model
3. Modeling the CV system responses to hemorrhage and transfusion with and without CNS control systems intact.
4. Analysis of Valsalva response in exercise and bed rest
5. Hestiographic analysis of cardiac arryhythmiacs in normal and post-cardia surgery patients is being initiated.

COMPUTER RESOURCE   Section II-B

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: J. von der Groeben, M.D.

Department: Department of Anesthesia

Institution: Stanford University School of Medicine

Field of Investigation: Cardiovascular Research

Title of Research Project:

Direct Grant or Contract Support of Project

Identification Number	Funding Agency	Current Annual Amount
1. HE-10202	NIH	$66,599.00
2.		
3.		
4.		
5.		
6.		
7.		

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
40					

Description of Research Project
(Approximately 300 words)

1. Diagnostic classification of electrocardiogram.

2. On-line monitoring system for the operating room and Coronary Care Unit.

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: Donald C. Harrison, M.D.

Department: Medicine - Cardkology

Institution: Stanford Medical School

Field of Investigation: Cardio-vascular

Title of Research Project: A) Force - Velocity Relationships in Intact Hearts B) Use of a Computer for Physiologic Study during Cardiac
Catheterization

Direct Grant or Contract Support of Project

	Identification Number	Funding Agency	Current Annual Amount
1.	HE 09058-03	National Heart Institute	$23,565.
2.			
3.			
4.			
5.			
6.			
7.			

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
80					

Description of Research Project
(Approximately 300 words)

A) The use of a computer program for calculation of force-velocity relationships in intact dog hearts in order to determine the nature of inotropic responses to physiologic and pharmalogic stimuli is anticipated.

B) The calculation of all physiologic data from cardiac catheterization laboratory in an on-line situation is planned.

INDIVIDUAL PROJECT DESCRIPTION

Period Covered 12-15-66 to 4-30-67

Investigator: Sidney Liebes, Jr.

Department: Genetics

Institution: Stanford Medical School

Field of Investigation: High Spatial Resolution Mass Spectral Analysis
                          of Solid Biological Materials
Title of Research Project:

Direct Grant or Contract Support of Project

Identification Number	Funding Agency	Current Annual Amount
1. NsG 81-60	NASA	$500,000
2.		
3.		
4.		
5.		
6.		
7.		

Amount of Resource Services Received
(reported in hours and in amount paid for services)

Consulting/Programming		Peripheral Equipment		Computer Equipment	
hours	amount	hours	amount	hours	amount
		20 (Babcock)			

Description of Research Project
(Approximately 300 words)

This project is directed toward the development of procedures for performing high spatial resolution mass spectral analysis of biological materials.

Attention is, or it is anticipated will be, devoted to: 1) sample preparation, 2) sample introduction into the vacuum environment of the mass spectrometer, 3) sample vaporization, 4) sample ionization, 5) mass spectral analysis, 6) ion detection, 7) data capture, 8) data storage, 9) data manipulation and interpretation, 10) collection of mass spectral finger print files, 11) mass spectral comparison, etc.

It is anticipated that computer interaction will be accomplished in most of the above areas, the nature of the interaction ranging from experimental to routine.

Resource Equipment List   Section II-C
May 1967

Equipment Description	Model Number	Mfgr.	Purchase Price	Annual Rental	Source of Funds
360/50 System (Note A)		IBM			
1 Processing Unit	2050F			$ 64,578	SRR (Note A)
1 Printer Keyboard	1052-7			500	"
1 Core Storage Unit	2361-1			35,350	"
1 Control Unit	2821-1			8,586	"
1 Printer	1403-2			6,605	"
1 Magnetic Tape Unit	2401-1			2,650	"
1 Magnetic Tape & Control Unit	2403-1			7,772	"
2 Disk Storage Drives	2311-1			9,062	"
1 Data Cell Drive	2321-1			22,157	"
1 Data Adapter Unit	2701			7,780	"
1 Transmission Control Unit	2702-1			9,807	"
1 Storage Control Unit	2841-1			5,883	"
1 Card Reader Punch	2540			5,221	"
20 Communication Terminals (Note B)	2741			16,800	"
1 Magnetic Tape Unit	2402-1			6,144	Stanford CompCntr
1800 System		IBM			
1 Process Controller	1801		76,694		Other Fed Agency
1 Printer Keyboard	1816		2,438		"
1 Enclosure	1828		333		"
1 Analog Input Terminal	1851		2,908		"
1 Analog Output Terminal	1856		6,540		"
1 Data Adapter Unit	1826	IBM		7,188	SRR
1 System 360 Adapter	7720	IBM		1,500	SRR
1 Card Read Punch	1442	IBM		2,544	SRR
1 Card Punch	029	IBM		744	SRR
4 Data Sets	103A2	Western Elec.		1,440	SRR

Note A - The annual rental for the 360/50 system is cost less the 20% to be paid
by Stanford Computation Center in exchange for 20% of the time. All
rentals above are also subject to 4% California use tax.

Note B - Sixteen of these terminals are installed in various laboratories of
medical researchers outside the main resource area.

STANFORD UNIVERSITY

Advanced Computer for Medical Research

Special Research Resource   FR 00311-01

Summary of Publications

Invited presentations have resulted in the following publications:

1)   ONR   Workshop on Psycho-biology & Computers   5/17/66
                (Naval Post-Graduate School, Monterey,
                California)

                Published in Proceedings

2)   Argonne National Laboratories   11/1/66

                Conference on Time-Sharing Model 50's

                To be published as part of Proceedings

3)   A joint effort of IBM and four 1800 users,   11/29/66
      including ACME has been published by the COMMON
      users group

                "Report of the 1800 Time Sharing Executive
                System Review Committee"

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mputer for Medical Research - Special Research Resource FR 00311-01

SUMMARY OF RESOURCE EXPENDITURES

Table III-A

Total Resource Operations - Total Expenditures

	Current Budget Period			Estimate Next Budget Period
	Actual 7 months	Estimate 4 months	11 mos. Total	
	$ 80,173	$ 55,225	$135,398	$187,795
	8,417	5,799	14,216	19,718
	88,590	61,024	149,614	207,513
	1,389	142,374	143,763	252,240
	88,913	86,952	175,865	16,274
	11,057	4,595	15,652	744
	101,359	233,921	335,280	269,258
	23,305	15,300	38,605	49,706
	2,266	1,900	4,166	4,000
	64,300	-	64,300	-
	4,799	3,200	7,999	-
	6,678	3,500	10,178	11,576
	291,297	318,845	610,142	542,053
	44,096	29,942	74,038	103,287
	335,393	348,787	684,180	645,340
	$335,393	$348,787	$684,180	$645,340
	-	-	-	-

SRR Expenditures Allocated to Supported Operations
(percentage of support if applicable *)

	Actual Previous Budget Period	Current Budget Period			Estimate Next Budget Period
		Estimate 7 months	Estimate 4 months	11 mos. Total	
		$ 49,612	$ 38,140	$ 87,752	$187,795
		5,209	4,005	9,214	19,718
		54,821	42,145	96,966	207,513
			142,374	142,374	252,240
			64,752	64,752	-
		10,577	595	11,172	744
		10,577	207,721	218,298	252,984
		18,716	15,000	33,716	44,000
		900	1,000	1,900	4,000
		29,300	-	29,300	-
		4,652	3,000	7,652	-
		4,938	3,500	8,438	11,576
		123,904	272,366	396,270	520,073
		27,287	20,977	48,264	103,287
		151,191	293,343	444,534	623,360
		$151,191	$293,343	$444,534	$623,360
	-	-	-	-	-
	0.0%	45.1%	84.1%	65.0%	96.6%

STANFORD UNIVERSITY
uter for Medical Research - Special Research Resource FR 00311-01

SUMMARY OF RESOURCE FUNDING

Table III - B

Funds Allocated to SRR Supported Operations
(percent of allocation if applicable ___)

Actual Previous Budget Period	Current Budget Period			Estimate Next Budget Period
	Actual 7 months	Estimate 4 months	Total 11 months	
	$ 151,191	$ 293,343	$ 444,534	$ 623,360
	151,191	293,343	444,534	623,360
	$ 151,191	$ 293,343	$ 444,534	$ 623,360

otal Resource Operations - Total Funds

	Current Budget Period			Estimate Next Budget Period
	Actual 7 months	Estimate 4 months	Total 11 months	
	$ 151,191	$ 293,343	$ 444,534	$ 623,360
221	88,913	22,200	111,113	16,274
	78,480	28,593	107,073	5,706
221	318,584	344,136	662,720	645,340
28	16,809	4,651	21,460	-------
49	$ 335,393	$ 348,787	$ 684,180	$ 645,340

irect costs at 55% on salaries charged to a grant from a non Federal agency.

STANFORD UNIVERSITY

Advanced Computer for Medical Research - Special Research Resource FR 00311-01

Expenditure Details
Direct Costs Only

Table III-C

Name	Date of Hire if after 9/1/66	% of Time or Effort	% of SRR Support	11 mos. Current Budget Period		Est. for Next Budget Period	
				Total	SRR	Total	SRR
I Personnel							
1. Principal Investigator							
J. Lederberg				-	-	-	-
2. Associate Director							
G. Wiederhold		100	100	$ 13,453	$ 13,453	$ 16,538	$ 16,538
3. Systems Programmers							
G. Breitbard		100	-	10,150	-	12,540	12,540
L. Crouse	5/1/67	100	100	3,409	3,409	9,720	9,720
D. Cummins		100	100	11,150	-	13,608	13,608
G. Hintz		100	100	8,800	-	10,368	10,368
J. Miller	Term.3/31/67	100	100	6,525	6,525	-	-
A. Patel	1/4/67	100	100	2,865	-	-	-
"	5/1/67	100	100	2,175	2,175	9,396	9,396
W. Sanders	1/9/67	100	100	7,377	7,377	14,040	14,040
F. Zwieman (Trainee)	10/3/66	50	50	1,350	-	-	-
4. Engineers							
J. Flexer		100	-	11,500	-	(2 mos)2,330	2,330
K. Holtz		100	100	10,850	10,850	12,960	12,960
5. Statisticians							
Z. LaHorgue	10/3/66-3/31/67	50	50	2,250	2,250	-	-
M. Moore	2/1/67	100	100	3,300	3,300	6,930	6,930
Open Position						9,600	9,600
6. Electronic Technicians							
M. Connery	1/4 - 3/31/67	100	100	1,181	1,181	-	-
7. Computer Technicians							
D. Osborne	8/15/66	100	100	4,026	4,026	5,990	5,990
A. Weatherby	12/27/66	100	100	1,280	1,280	4,992	4,992

STANFORD UNIVERSITY

Advanced Computer for Medical Research - Special Research Resource FR 00311-01

Expenditure Details
Direct Costs Only

Table III-C

Name	Date of Hire if after 9/1/66	% of Time or Effort	% of SRR Support	Current Budget Period 11 mos.		Est. for Next Budget Period	
				Total	SRR	Total	SRR
I Personnel (continued)							
8. Computer Operations Supervisor C. Class	9/19/66	100	100	$ 8,126	$ 8,126	$ 9,639	$ 9,639
9. Computer Operators Various - provided by SCC *		-	-	10,562	10,562	27,240	27,240
10. User Education Director V. Wiederhold		40	40	2,625	2,625	3,920	3,920
11. Secretaries J. Togay	Term.10/21/66	100	-	1,015	-		
T. Zilka	11/28/66	100	100	3,871	3,871	5,928	5,928
12. Project Administrative Assistance Various - provided by SCC *		-	-	2,411	2,411	5,456	5,456
13. Machinists Various - charged by hour		-	-	1,987	1,543	1,800	1,800
14. Part-time Assistants		-	-	3,160	2,788	4,800	4,800
Subtotal Direct Salaries				135,398	87,752	187,795	
Fringe Benefits				14,216	9,214	19,718	
Subtotal Personnel				$ 149,614	$ 96,966	$ 207,513	

* Stanford Computation Center

ACME Expenditure Details
Direct Costs Only   Table III-C

	Current Budget Period		Estimate for Next Budget Period	
	Total	SRR	Total	SRR
II Permanent Equipment				
Main Resource - Rental				
IBM 360/50 System (a)				
1 205F Processing Unit	$ 40,875	$ 40,875	$ 64,578	$ 64,578
1 1052 Printer Keyboard, Mdl 7	317	317	500	500
1 2361 Core Storage Unit, Mdl 1	22,374	22,374	35,350	35,350
1 2821 Control Unit, Mdl 1	5,434	5,434	8,586	8,586
1 1403 Printer, Mdl 2	4,190	4,190	6,605	6,605
1 2401 Magnetic Tape Unit, Mdl 1	1,677	1,677	2,650	2,650
1 2403 Magnetic Tape & Control, Mdl 1	4,918	4,918	7,772	7,772
2 2311 Disk Storage Drives, Mdl 1	5,738	5,738	9,062	9,062
1 2321 Data Cell Drive, Mdl 1	14,023	14,023	22,157	22,157
1 2701 Data Adapter Unit	4,925	4,925	7,780	7,780
1 2702 Transmission Control Unit, Mdl 1	6,211	6,211	9,807	9,807
1 2841 Storage Control Unit, Mdl 1	3,797	3,797	5,883	5,883
1 2540 Card Reader Punch	3,306	3,306	5,221	5,221
20 2741 Communication Terminals	10,638	10,638	16,800	16,800
1 2402 Magnetic Tape Unit, Mdl. 1	-	-	-	-
IBM 1800 - additional costs				
1826 - Data Adapter Unit	3,338	3,338	7,188	7,188
1442 - Card Read Punch	2,271	882	2,544	2,544
Maintenance	1,028	1,028	2,052	2,052
7720 - System 360 Adapter	625	625	1,500	1,500
Data sets, lines and installation	2,341	2,341	5,676	5,676 *
IBM 1360 Disk Packs	600	600	1,728	1,728 *
4% Sales Tax on equipment leases	5,137	5,137	8,801	8,801 *
Utilization of 360/67 Computer			20,000	20,000 *
Subtotal - Main Resource - rental	$ 143,763	$ 142,374	$ 252,240	$ 252,240

* Estimates only.

(a) Cost shown for all but the last two items of the 360/50 system is 80% of actual cost. Stanford Computation Center is to pay 20% of the cost in exchange for 20% of time. The 2741's are 100% SRR and the 2402 is 100% Computation Center.

Table III-C

	Current Budget Period		Estimate for Next Budget Period	
	Total	SRR	Total	SRR
II Permanent Equipment (continued)				
Main Resource - Purchased				
IBM 1800 System				
1 1801 Process controller	$ 76,694	-	-	-
1 1816 Printer Keyboard	2,438	-	-	-
1 1828 Enclosure	333	-	-	-
1 1851 Multiplex Terminal	2,908	-	-	-
1 1856 Analog Optical Terminal	6,540	-	-	-
Sanders Display Equipment				
1 701 Control Unit	-	-	$ 2,600	-
1 703 Edit Module	-	-	1,040	-
2 705-A Memory Modules	-	-	3,120	-
2 708 Display Consules	-	-	5,304	-
1 713-B Equipment Rack & Power Supply	-	-	988	-
2 722 Alpha Numeric Keyboard	-	-	988	-
1 712 Parallel Interface Module	-	-	884	-
Cable and Installation	-	-	1,350	-
Digital Display Unit	8,796	$ 8,796 *		
Instrument Data Lines				
22 Low Data Rates	(b) 1,156	1,156		
4 Medium Data Rates	(b) 1,200	1,200		
2 High Data Rates	(b) 1,000	1,000		
Installation Costs	(b) 2,000	2,000		
IBM 270X & OY Transmission Device (SRR Partial Support)	72,800	50,600	-	-
Subtotal - Main Resource - Purchased	$ 175,865	$ 64,752	$ 16,274	-
Supporting Equipment				
1 029 IBM Keypunch	701	221	744	744
Magnetic tapes	5,041	4,500	-	-
HP-180A Oscilloscope	2,479	-	-	-
10 Data Cells for IBM 2321 Drive	3,640	3,640	-	-
Storage for Cards, Disk Packs, Paper & Tapes	2,570	2,570	-	-
Honeywell Humidity & Temp. Recorder	241	241	-	-
Misc. Engineering Equipment	980	-	-	-
Subtotal - supporting equipment	$ 15,652	$ 11,172	$ 744	$ 744
Subtotal - Equipment	$ 335,280	$ 218,298	$269,258	$ 252,984

(b) Portion of costs included in salaries and supplies.

*   Estimates only.

ACME Expenditure Details
Direct Costs Only   Table III-C

		Current Budget Period		Estimate for Next Budget Period	
		Total	SRR	Total	SRR
III.	CONSUMABLE SUPPLIES				
	1. Computer supplies	$ 2,365	$ 2,365	$ 20,000	$ 20,000 *
	2. Engineering and maintenance	33,630	29,770	25,706	20,000 *
	c. Office supplies	2,610	1,581	4,000	4,000 *
	Subtotal Consumable Supplies	38,605	33,716	49,706	44,000 *
IV.	TRAVEL	4,166	1,900	4,000	4,000 *
V.	ALTERATIONS & RENOVATIONS	64,300	29,300	------	-----
VI.	EQUIPMENT TIME				
	1. Allen Babcock Computers	7,353	7,232	------	-----
	2. Stanford Computation Center	646	420	(c)	(c)
	Subtotal Equipment Time	7,999	7,652	------	-----
VII.	OTHER EXPENDITURES				
	1. Publication Expense	2,056	2,056	8,000	8,000 *
	2. Telephone, postage	3,849	2,699	2,576	2,576 *
	3. Guard Service (prior to full operator service)	2,556	2,556	------	-----
	4. Other	1,717	1,127	1,000	1,000 *
	Subtotal Other Expenditures	10,178	8,438	11,576	11,576 *
GRAND TOTAL DIRECT COSTS		$ 610,142	$ 396,270	$ 542,053	$ 520,073

(c) See Major Resources - Rented Equipment - $20,000 utilization of 360/67.

*   Estimates only.